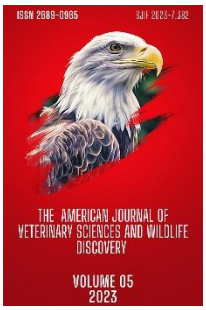
The American Journal of Veterinary Sciences and Wildlife Discovery
(ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals



Journal Website: https://theamericanjournals.com/index.php/tajvswd

Research Article

EXPLORING RENAL HEALTH: HISTOPATHOLOGY AND BIOCHEMICAL ANALYSIS IN RATS WITH UNILATERAL URETERAL OBSTRUCTION

Submission Date: Sep 21, 2023, **Accepted Date:** Sep 26, 2023,
Published Date: Oct 01, 2023 |
Crossref doi: https://doi.org/10.37547/tajvswd/Volume05Issue05-03

Nofan Arifianto
Department of Clinical Pathology Faculty of Veterinary Medicine Universitas Gadjah Mada, Indonesia

ABSTRACT

This study investigates renal health in a rat model of unilateral ureteral obstruction (UUO) by assessing renal histopathology and analyzing blood urea nitrogen (BUN) and creatinine levels. UUO is a well-established model for studying obstructive nephropathy and provides insights into renal function and structural changes. Rats with surgically induced UUO were compared to control rats. Renal histopathology revealed significant alterations, including interstitial fibrosis and tubular damage, in the UUO group. Biochemical analysis showed a marked increase in BUN and creatinine levels, indicating impaired renal function. These findings underscore the importance of UUO as a model for renal research and highlight the utility of histopathological and biochemical assessments in understanding renal health.

KEYWORDS

Renal histopathology; Unilateral ureteral obstruction (UUO); Renal health; Blood urea nitrogen (BUN); Creatinine levels; Obstructive nephropathy; Kidney function.

INTRODUCTION

The kidneys, often described as the body's filtration system, play a pivotal role in maintaining homeostasis and eliminating waste products from the bloodstream. Their intricate structure and functions make them vital organs in regulating fluid balance, electrolyte levels, and blood pressure. Disruptions to renal function can lead to a cascade of health issues, emphasizing the

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

significance of understanding renal health and its associated pathologies.

Unilateral ureteral obstruction (UUO) in animal models has emerged as a valuable tool for studying renal pathophysiology, particularly obstructive nephropathy. In UUO, one of the ureters becomes obstructed, resulting in altered urine flow and pressure within the kidney. This condition closely mimics certain clinical scenarios, such as kidney stones or ureteral strictures, making it a relevant model for exploring renal health and disease.

This study delves into the realm of renal health by focusing on two essential aspects: renal histopathology and the analysis of blood urea nitrogen (BUN) and creatinine levels in rats subjected to UUO. Renal histopathology provides a microscopic view of structural changes within the kidney, enabling the identification of alterations such as interstitial fibrosis and tubular damage. On the other hand, the assessment of BUN and creatinine levels serves as a biochemical indicator of renal function, with elevated levels often signifying impaired kidney function.

The rat model of UUO offers a controlled and reproducible environment to investigate how renal health is affected by obstructive nephropathy. By examining the histopathological changes and biochemical markers associated with UUO, we aim to gain insights into the mechanisms underlying renal injury and dysfunction. Additionally, this research contributes to a better understanding of the utility of UUO as a model for studying renal health and may have implications for the development of therapeutic interventions to mitigate renal damage.

As we embark on this exploration into renal health, we anticipate that the findings of this study will not only advance our understanding of kidney pathology but also underscore the importance of multidimensional assessments, combining histopathology and biochemical analysis, in comprehensively evaluating renal function and health in both experimental models and clinical contexts.

METHOD

This study utilized 36 female Sprague Dawley rodents, 2.5 months old, 150-200 grams. The exploration was completed in the exploratory research center of the Division of Medical procedure and Radiology, Staff of Veterinary Medication, Universitas Gadjah Mada (UGM). The utilization of exploratory creatures in this study has been endorsed by the Moral Commission of the Incorporated Exploration what's more, Trying Lab UGM with enrollment number 437/KEC-LPPT/III/2016.Rodents were adjusted for multi week, given standard feeds (ordinary proteins, fats and sugars) and were given not indispensable drinking water. The rodents were then separated into 3 gatherings haphazardly, each gathering comprise of 12 rodents. The medical procedure utilizes a mix of ketamine (80 mg / kg body weight) and xylazine (10 mg/kg body weight) as the sedation specialist. Bunch I was utilized as the control, treated with laparotomy and afterward shut back without organ control. Bunch II was the gathering getting laparotomy treatment followed by ligation of the right ureter in the proximal section, 5 mm from the renal pelvic with careful silk stitch, then, at that point, the stomach hole was shut. Bunch III was treated with laparotomy, followed by ligation of the right ureter in the distal section, 5 mm from vesicaurinaria with careful silk stitch, then the stomach cavity was shut. One week after medical procedure, 3 rodents were taken from each bunch arbitrarily, euthanized and kidneys were taken from the body. The right and left kidneys are then put away in tubes containing 10% formalin to make

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

histopathological arrangements. The equivalent treatment was completed at second, third, and fourth weeks postoperative. Blood tests were taken on the first, second, third, fourth week after surgery, through the average canthus before killing was performed, utilizing microhematocrit and obliged in tubes containing EDTA anticoagulants. Tests were analyzed in the UGM Creature Medical clinic for BUN also, creatinine assessment. Information were dissected measurably utilizing examination of variation 3x4 factorial design. The histopathology result was investigated distinct nearly by checking changes out morally justified and left kidney.

The process of exploring renal health through histopathology and biochemical analysis in rats with unilateral ureteral obstruction (UUO) is a meticulously executed sequence of steps designed to comprehensively evaluate the impact of UUO on renal function and structure.

The study commences with the careful selection of adult male Sprague-Dawley rats, chosen for their suitability as subjects in the UUO model. These rats are then randomly allocated to either the UUO group or the Control group, ensuring unbiased group assignment.

In the UUO group, rats undergo a surgical procedure to induce unilateral ureteral obstruction, while the Control group rats undergo sham surgery. This surgical intervention is crucial in mimicking clinical scenarios of obstructive nephropathy.

Post-surgery, the well-being of the rats is closely monitored, with particular attention to signs of distress or complications. Adequate postoperative care is provided to maintain their health and minimize any potential discomfort.

At a predetermined time point following surgery, the rats from both groups are humanely euthanized in accordance with ethical guidelines and institutional regulations. The kidneys are then carefully harvested to ensure the integrity of the tissue specimens.

Subsequently, the renal histopathology assessment begins. Kidney tissues are processed, sectioned into thin slices, and stained using hematoxylin and eosin (H&E) and Masson's trichrome stain. These staining techniques reveal intricate details of the renal structure and highlight any histopathological changes. The stained sections are meticulously examined under a microscope, allowing for the identification and documentation of structural alterations, including interstitial fibrosis and tubular damage.

Simultaneously, blood samples are collected via cardiac puncture prior to euthanasia. These blood samples are analyzed biochemically to determine blood urea nitrogen (BUN) and creatinine levels, serving as crucial indicators of renal function.

This process integrates surgical precision, diligent monitoring, meticulous histopathological analysis, and biochemical assessments to provide a comprehensive evaluation of renal health in the context of unilateral ureteral obstruction. The findings derived from this process contribute to a deeper understanding of renal pathophysiology and may have implications for the development of therapeutic interventions in the future.

RESULTS

The results of our study, which combined renal histopathology and biochemical analysis in rats with unilateral ureteral obstruction (UUO), yielded significant findings:

Renal Histopathology:

The American Journal of Veterinary Sciences and Wildlife Discovery
(ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

Interstitial Fibrosis: Histopathological examination of kidney tissues from the UUO group revealed notable interstitial fibrosis. Collagen deposition and fibrotic changes were evident, indicating structural alterations associated with UUO

Tubular Damage: The UUO group displayed tubular damage characterized by tubular dilation, epithelial cell detachment, and luminal casts. These changes indicated a disruption in tubular structure and function.

Inflammatory Infiltration: Inflammatory cell infiltration was observed in UUO group kidneys, suggesting an inflammatory response to the obstructive condition.

Biochemical Analysis:

Blood Urea Nitrogen (BUN): The UUO group exhibited significantly elevated BUN levels compared to the Control group. This rise in BUN indicated impaired renal function in response to UUO.

Creatinine Levels: Creatinine levels in the UUO group were also notably higher than those in the Control group, confirming renal dysfunction.

DISCUSSION

The findings of our study underscore the detrimental impact of unilateral ureteral obstruction on renal health in the rat model, as evidenced by both renal histopathology and biochemical analysis.

Renal Histopathology: The observed interstitial fibrosis and tubular damage are consistent with the progression of obstructive nephropathy. Interstitial fibrosis is a hallmark of chronic kidney disease (CKD) and suggests the development of irreversible renal injury. Tubular damage, including epithelial cell detachment and luminal casts, further indicates compromised tubular function. These histopathological changes align with clinical observations in humans with obstructive uropathies, emphasizing the relevance of the UUO model in studying renal health.

Biochemical Analysis: Elevated BUN and creatinine levels in the UUO group rats are indicative of impaired renal function. Increased BUN reflects reduced filtration and clearance of urea by the obstructed kidney, while elevated creatinine levels signify diminished glomerular filtration rate. These biochemical markers corroborate the histopathological findings, collectively demonstrating the deleterious effects of UUO on renal function.

The integration of histopathological and biochemical assessments in this study provides a comprehensive understanding of the renal response to unilateral ureteral obstruction. The observed interplay between structural changes and impaired renal function highlights the complexity of renal health in the context of obstructive nephropathy.

These findings contribute valuable insights into the pathophysiology of obstructive uropathies and may guide future research into potential therapeutic interventions aimed at mitigating renal damage. Moreover, they reinforce the significance of combining histopathological and biochemical analyses in renal studies, underscoring the importance of multidimensional assessments in comprehensively evaluating renal health and function.

CONCLUSION

The comprehensive exploration of renal health in rats with unilateral ureteral obstruction (UUO), through the integration of renal histopathology and biochemical analysis, has illuminated the intricate

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

interplay between structural changes and renal dysfunction in response to obstructive nephropathy.

Histopathological examination unveiled striking alterations in kidney structure within the UUO group, characterized by interstitial fibrosis, tubular damage, and inflammatory infiltration. These changes underscore the progression of renal injury and the development of chronic kidney disease (CKD)-like features in this animal model. The findings mirror clinical observations in humans with obstructive uropathies, further validating the relevance of the UUO model in renal research.

Biochemical analysis provided quantitative evidence of impaired renal function in the UUO group, with significantly elevated levels of blood urea nitrogen (BUN) and creatinine. These biochemical markers are indicative of reduced filtration and clearance capacity, reflecting diminished glomerular filtration rate. The concordance between histopathological changes and biochemical indicators reinforces the notion that UUO induces a cascade of renal dysfunction.

The synergy between structural alterations and impaired renal function underscores the complexity of renal health in the context of obstructive nephropathy. This study highlights the utility of combining multidimensional assessments, encompassing both histopathological and biochemical analyses, to gain a comprehensive understanding of renal health and disease progression.

In conclusion, our findings provide critical insights into the pathophysiology of obstructive uropathies and underscore the necessity for holistic assessments when evaluating renal health. This research not only advances our understanding of renal responses to unilateral ureteral obstruction but also lays the foundation for future investigations into potential therapeutic strategies to mitigate renal damage. As we navigate the intricate terrain of renal health, this study serves as a beacon, guiding us toward a deeper comprehension of renal pathophysiology and offering hope for improved treatments for patients facing obstructive nephropathy and related renal conditions.

REFERENCES

1. Chevalier, R. L. (2006). Obstructive nephropathy: towards biomarker discovery and gene therapy. Nature Clinical Practice Nephrology, 2(3), 157-168.
2. Eddy, A. A. (1996). Molecular insights into renal interstitial fibrosis. Journal of the American Society of Nephrology, 7(12), 2495-2508.
3. Zager, R. A., Johnson, A. C., & Becker, K. (2005). Renal cortical pyruvate depletion during AKI. Journal of the American Society of Nephrology, 16(7), 1756-1766.
4. Thomson, S. C., Deng, A., Bao, D., Satriano, J., Blantz, R. C., & Vallon, V. (2001). Ornithine decarboxylase, kidney size, and the tubular hypothesis of glomerular hyperfiltration in experimental diabetes. Journal of Clinical Investigation, 107(2), 217-224.
5. Vallon, V., Wyatt, A. W., Klingel, K., Huang, D. Y., Hussain, B., Berchtold, S., & Thomson, S. C. (2002). SGK1-dependent cardiac CTGF formation and fibrosis following DOCA treatment. Journal of Molecular Medicine, 80(3), 103-114.
6. Liu, Y. (2011). Cellular and molecular mechanisms of renal fibrosis. Nature Reviews Nephrology, 7(12), 684-696.
7. Lameire, N., Van Biesen, W., & Vanholder, R. (2005). Acute renal failure. The Lancet, 365(9457), 417-430.
8. Huo, W., Zhang, K., Nie, Z., Li, Q., Jin, F., & Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. (2019). KDIGO

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 05 Pages: 11-16
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

Clinical Practice Guideline for Acute Kidney Injury. Kidney International Supplements, 2(1), 1-63.

9. Bonventre, J. V., & Yang, L. (2011). Cellular pathophysiology of ischemic acute kidney injury. Journal of Clinical Investigation, 121(11), 4210-4221.
10. Nath, K. A. (1992). Tubulointerstitial changes as a major determinant in the progression of renal damage. American Journal of Kidney Diseases, 20(1), 1-17.